

Claims

1. A method of providing a yarn or textile product with a desired property which comprises:

contacting a linker molecule comprising two or more activatable chemical groups with a yarn or textile product, and a non-linker molecule having a desired property;

activating the activatable chemical groups of the linker molecule to cause covalent attachment of the linker molecule to the yarn or textile product and the non-linker molecule, thereby attaching the non-linker molecule to the yarn or textile product by means of the linker molecule, and providing the yarn or textile product with the property of the non-linker molecule.

2. A method according to claim 1, wherein the non-linker molecule is covalently attached to the yarn or textile product in a single reaction step.

3. A method according to claim 1 or 2, wherein the linker molecule is contacted with the yarn or textile product before the non-linker molecule.

4. A method according to any preceding claim, wherein the non-linker molecule is a solvent, a synthetic or natural chemical, a synthetic or natural dye, a synthetic polymer, a biopolymer, a biomolecule, a biologically active molecule, a synthetic or natural vitamin or hormone, or any combination thereof.

5. A method according to any preceding claim, wherein the non-linker molecule is an enzyme (such as lysozyme), a growth factor, an anti-microbial agent, an antibiotic, a fungicide, an agent capable of suppressing the proliferation of bacteria or fungi, or any combination thereof.

6. A method according to any preceding claim, wherein the linker molecule further comprises one or more functional groups having a desired property different to the property of the non-linker molecule, so that covalent attachment of the linker

molecule to the yarn or textile product additionally provides the yarn or textile product with the property of the, or each functional group.

7. A method of providing a yarn or textile product with a desired property which comprises:

contacting a linker molecule comprising one or more activatable chemical groups, and one or more functional groups having a desired property, with a yarn or textile product;

activating the activatable chemical group or groups of the linker molecule to cause covalent attachment of the linker molecule to the yarn or textile product, thereby providing the yarn or textile product with the property of the functional group of the linker molecule.

8. A method according to claim 6 or 7, wherein the, or each functional group is a positively charged group at neutral pH (such as an amino group), a negatively charged group at neutral pH (such as a carboxyl group), a thiol group, or a dye such as a fluorescent dye.

9. A method according to claim 8, wherein the, or each functional group is negatively charged, and the method further comprises contacting the yarn or textile product with positively charged metal ions, preferably silver ions, to bind the metal ions to the functional group or groups.

10. A method according to claim 9, wherein the metal ions are contacted with the yarn or textile product before the linker molecule.

11. A method according to any preceding claim, wherein the linker molecule is multiply substituted with activatable chemical groups.

12. A method according to any preceding claim, wherein activation of the, or each activatable chemical group of the linker molecule generates a carbene intermediate.

13. A method according to any preceding claim, wherein the, or each activatable chemical group is activated with actinic energy and converts to a highly reactive intermediate.

14. A method according to any preceding claim, wherein the, or each activatable chemical group of the linker molecule is thermochemically or photochemically activatable.

15. A method according to any preceding claim, wherein the linker molecule comprises a natural or synthetic polymer, preferably a biopolymer.

16. A method according to claim 15, wherein the linker molecule comprises a protein, peptide, or polysaccharide.

17. A method according to claim 15, wherein the linker molecule comprises a dextran-based polymer.

18. A method according to any preceding claim, wherein the linker molecule comprises a cleavage site which is cleaved under predetermined conditions to release the non-linker molecule or functional group from the yarn or textile product.

19. A method according to claim 18, wherein the linker molecule comprises a target for a hydrolytic enzyme to allow enzyme-induced, or biosystem-induced release of the non-linker molecule or functional group.

20. A method according to claim 18 or 19, wherein the linker molecule comprises a substrate for an endoglycosidase, or an endopeptidase.

21. A method according to claim 19, wherein the linker molecule is a dextran-based biopolymer which comprises a target for a dextranase.

22. A method according to claim 19, wherein the linker molecule is a hyaluronic acid-based biopolymer which comprises a target for a hyaluronidase.
23. A method according to claim 19, wherein the linker molecule is a protein-based polymer which comprises a target for a protease.
24. A method according to claim 19, wherein the linker molecule is a peptide-based polymer which comprises a target for an endopeptidase.
25. A method according to any preceding claim, wherein the yarn or textile product is of natural or synthetic origin, a blend of synthetic yarns, or a blend of natural and synthetic yarns.
26. A method according to any preceding claim, wherein the yarn or textile product is pre-treated to improve its wetting properties.
27. A method according to claim 26, wherein the yarn or textile product is pre-treated with oxygen plasma.
28. A method according to claim 26 or 27, wherein the yarn or textile product is synthetic polyester.
29. A linker molecule for use in a method according to claim 1, the linker molecule comprising a polysaccharide and two or more activatable chemical groups.
30. A linker molecule for use in a method according to claim 7, the linker molecule comprising one or more activatable chemical groups, and one or more functional groups, each functional group having a desired property.
31. A linker molecule as defined in any of claims 6 to 9, or 17 to 24.

32. Use of a linker molecule as defined in any of claims 1, 6 to 9, or 11 to 24 to covalently attach a non-linker molecule having a desired property and/or a functional group having a different desired property to a yarn or textile product, thereby providing the yarn or textile product with the desired property or properties.

33. A yarn or textile product covalently attached, by means of a linker molecule, to a non-linker molecule having a desired property, thereby providing the yarn or textile product with the desired property, wherein covalent attachment of the non-linker molecule to the yarn or textile product is the result of reaction of reactive intermediates generated from activatable chemical groups provided by the linker molecule with the yarn or textile product and the non-linker molecule.

34. A yarn or textile product according to claim 33, wherein covalent attachment of the non-linker molecule to the yarn or textile product is the result of reaction of reactive intermediates generated from thermochemically or photochemically activatable chemical groups provided by the linker molecule.

35. A yarn or textile product according to claim 33 or 34, wherein covalent attachment of the non-linker molecule to the yarn or textile product is the result of reaction of carbene intermediates generated from activatable chemical groups provided by the linker molecule.

36. A yarn or textile product according to any of claims 33 to 35, wherein the non-linker molecule is a solvent, a synthetic or natural chemical, a synthetic or natural dye, a synthetic polymer, a biopolymer, a biomolecule, a biologically active molecule, a synthetic or natural vitamin or hormone, or any combination thereof.

37. A yarn or textile product according to any of claims 33 to 36, wherein the non-linker molecule is an enzyme (such as lysozyme), a growth factor, an anti-microbial agent, an antibiotic, a fungicide, an agent capable of suppressing the proliferation of bacteria or fungi, or any combination thereof.

38. A yarn or textile product according to any of claims 33 to 37, wherein the linker molecule comprises one or more functional groups having a different desired property to that of the non-linker molecule, thereby additionally providing the yarn or textile product with the different desired property.

39. A yarn or textile product covalently attached to a linker molecule, the linker molecule comprising one or more activatable chemical groups to allow covalent attachment of a non-linker molecule having a desired property to the linker molecule and thereby provide the yarn or textile product with the desired property.

40. A yarn or textile product according to claim 39, wherein activation of the, or each activatable chemical group of the linker molecule generates a carbene intermediate.

41. A yarn or textile product according to claim 39 or 40, wherein the, or each activatable chemical group converts to a highly reactive intermediate when activated with actinic energy.

42. A yarn or textile product according to any of claims 39 to 41, wherein the, or each activatable chemical group of the linker molecule is thermochemically or photochemically activatable.

43. A yarn or textile product according to any of claims 39 to 42, wherein the linker molecule further comprises one or more functional groups having a desired property, thereby providing the yarn or textile product with the desired property.

44. A yarn or textile product covalently attached to a linker molecule, the linker molecule comprising one or more functional groups having a desired property, thereby providing the yarn or textile product with the desired property, wherein covalent attachment of the linker molecule to the yarn or textile product is the result of reaction of reactive intermediates generated from activatable chemical groups provided by the linker molecule with the yarn or textile product.

45. A yarn or textile product according to claim 44, wherein covalent attachment of the linker molecule to the yarn or textile product is the result of reaction of reactive intermediates generated from thermochemically or photochemically activatable chemical groups provided by the linker molecule.

46. A yarn or textile product according to claim 44 or 45, wherein covalent attachment of the linker molecule to the yarn or textile product is the result of reaction of carbene intermediates generated from activatable chemical groups provided by the linker molecule.

47. A yarn or textile product according to any of claims 38, 43, or 44 to 46, wherein the, or each functional group is a positively charged group at neutral pH (such as an amino group), a negatively charged group at neutral pH (such as a carboxyl group), a thiol group, or a dye such as a fluorescent dye.

48. A yarn or textile product according to claim 47, wherein the, or each functional group is negatively charged, and the yarn or textile product further comprises positively charged metal ions, preferably silver ions, bound to the functional group or groups.

49. A yarn or textile product according to any of claims 33 to 48, wherein the linker molecule comprises a natural or synthetic polymer, preferably a biopolymer.

50. A yarn or textile product according to claim 49, wherein the linker molecule comprises a protein, peptide, or polysaccharide.

51. A yarn or textile product according to claim 50, wherein the linker molecule comprises a dextran-based polymer.

52. A yarn or textile product according to any of claims 33 to 51, wherein the linker molecule comprises a cleavage site which is cleaved under predetermined

conditions to allow release of the non-linker molecule or functional group from the yarn or textile product.

53. A yarn or textile product according to claim 52, wherein the linker molecule comprises a target for a hydrolytic enzyme to allow enzyme-induced, or biosystem-induced release of the non-linker molecule.

54. A yarn or textile product according to claim 53, wherein the linker molecule comprises a substrate for an endoglycosidase, or an endopeptidase.

55. A yarn or textile product according to claim 53, wherein the linker molecule is a dextran-based biopolymer which comprises a target for a dextranase.

56. A yarn or textile product according to claim 53, wherein the linker molecule is a hyaluronic acid-based biopolymer which comprises a target for a hyaluronidase.

57. A yarn or textile product according to claim 53, wherein the linker molecule is a protein-based polymer which comprises a target for a protease.

58. A yarn or textile product according to claim 53, wherein the linker molecule is a peptide-based polymer which comprises a target for an endopeptidase.

59. A yarn or textile product according to any of claims 33 to 58 which is of natural or synthetic origin, a blend of synthetic yarns, or a blend of natural and synthetic yarns.

60. A composition comprising a yarn or textile product, a linker molecule according to any of claims 29 to 31, and optionally a non-linker molecule as defined in claim 36 or 37.